



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,962	01/28/2004	Lars W. Liebmann	FIS920030378	1961
29505	7590	09/28/2006		
DELIO & PETERSON, LLC 121 WHITNEY AVENUE NEW HAVEN, CT 06510			EXAMINER ROSASCO, STEPHEN D	
			ART UNIT	PAPER NUMBER

1756

DATE MAILED: 09/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/707,962

Applicant(s)

LIEBMANN ET AL.

Examiner

Stephen Rosasco

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/28, 1/29, 2/4/04</u> | 6) <input type="checkbox"/> Other: _____ |

Detailed Action

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 are rejected under 35 U.S.C. 102(e) as being anticipated by Lin et al. (6,492,073).

Lin et al. teach a method of forming images compensated for line shortening, comprising: providing a pattern having pattern elements comprising a number of line segments, wherein said line segments have one or two free ends which are not connected to other mask pattern elements; forming extended line segments by adding line extensions to said free ends of said line segments thereby forming a modified pattern, wherein each of said line extensions are equal to or greater than a first distance; forming a cutting pattern comprising rectangles enclosing each of said line extensions wherein one of the sides of said rectangles is coincident with the corresponding said free end of said line segment, said rectangle has a height equal to a second distance, and a width.

And wherein for two of said line segments said line extensions added to the nearest ends of these said line segments is sufficient to make the nearest ends of said extended line segments corresponding to these two said line segments contact each other if the centerlines of these two said line segments are parallel, the distance between the centerlines of these two said line segments is less than or equal to one half the sum of the

Art Unit: 1756

line width of these two said line segments, and the distance between the nearest ends of these two said line segments is less than ten multiplied by the largest expected line shortening for the corresponding said line segments

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda (6,811,954) or Liu (6,944,844) in view of Lin et al. (6,492,073).

The claimed invention is directed to a method of designing an alternating phase shifting mask for projecting an image of an integrated circuit design comprising: providing a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width; creating essentially parallel alternating phase shifting regions aligned with the critical width segments and extending beyond ends of at least some of the critical width segments; and creating an alternating phase shifting mask based on the alternating phase shifting regions.

And further including enclosing the integrated circuit layout and the alternating phase shifting regions within a boundary, and extending the alternating phase shifting regions to an edge of the boundary.

The applicant discusses the limitations of the prior art in that with regard to phase shift masks, the recessed regions on the mask have to form closed polygons and not all edges of these polygons can be made to coincide with desired layout images. The light

intensity decrease caused by these residual 180 degree phase steps leads to unwanted patterns on the wafer. These unwanted residual phase images are erased using a second exposure, commonly using a non-phase shifted mask.

Fukuda teach (see claims 3-8) a method of manufacturing a mask characterized in that, in manufacturing a mask for forming a circuit pattern on a substrate a pattern at a vicinity of a distal end portion of a linear aperture pattern having an adjacent pattern of the same phase arranged in a light shielding area within a predetermined distance therefrom is extracted and stored as first possible phase conflict region information, a pattern at a vicinity of an intersection of a linear aperture pattern extended in a vertical direction and a linear aperture pattern extended in a horizontal direction having different phases, respectively, is extracted and stored as second possible phase conflict region information, phase conflict resolving patterns for resolving phase conflicts are generated corresponding to respective regions by using the first and the second phase conflict region information, linear aperture complementary patterns for forming the desired circuit pattern by subjecting a same photosensitive substrate to multiple exposures along with the phase conflict resolving patterns are generated, and a first phase-shifting mask including the phase conflict resolving patterns and a second phase-shifting mask including the linear aperture complementary patterns are manufactured.

Liu teaches a method of determining an impact of line end shortening on a feature, the method comprising: simulating printing of predetermined points on the feature to determine line end shortening; and measuring a critical dimension at a predetermined location on the feature, based on the simulating, wherein the predetermined location is

associated with device performance, and wherein the predetermined location is outside an active region associated with the feature.

The teachings of Fukuda or Liu differ from those of the applicant in that they do not teach the specific relationship between critical width for phase shifters and line end.

Lin et al. is included here as recited above.

It would have been obvious to one having ordinary skill in the art to take the teachings of Fukuda or Liu and combine them with the teachings of Lin et al. in order to make the claimed invention because one would know that most of the lines with line end problems are parallel to each other.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Rosasco
Primary Examiner
Art Unit 1756